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FISCAL POLICY, INCOME DISTRIBUTION, AND GROWTH

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Foreword

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Abstract

This study seeks to discern whether the current distribution of income determines the evolution of future income distribution and economic growth through fiscal policy. Fiscal policy consists of transfer payments or an income tax. Fiscal policy is determined by the level of development, distribution of income, and degree of political franchise. Reduced form equations are obtained from the political equilibrium endogenous growth models addressing distributional issues. Empirical tests of these reduced form equations are carried out using cross-country data and time series data from India and Taipei,China. The cross-country evidence suggests that lagged income distribution is linked to future economic growth and income distribution through transfer payments. Time series evidence from Taipei,China suggests that low-income economies have to implement low levels of direct taxes, which is accompanied by a worsening distribution of income, in order to promote economic growth.

I. Introduction

The seminal study by Kuznets (1955) that sought to establish the efficacy of economic growth in improving income distribution has spawned an extensive literature. Subsequent studies by Ahluwalia (1976), Saith (1983), Papanek and Kyn (1986), Ram (1988), Anand and Kanbur (1993), Campano and Salvatore (1988), and Deininger and Squire (1998) have tried to identify whether a tradeoff between economic growth and inequality exists. These studies indicate limited support for the Kuznets hypothesis, which states that countries on a growth path from a low level of income to an intermediate level of income will incur a worsening distribution of income, and that on the growth path from the intermediate level of income toward the high level of income, the distribution of income improves. The results emanating from these studies are sensitive to sample choice and proxy for income distribution.

Recent studies on income distribution and endogenous growth by Alesina and Rodrik (1991), Alesina and Perotti (1993), Bertola (1991), Perotti (1993), Persson and Tabellini (1994), and Saint-Paul and Verdier (1991) return to the aforementioned debate. First, the new literature looks at the impact of inequality on growth rather than the reverse, as was the case with the earlier literature influenced by Kuznets (1955). Second, the interaction between income distribution, economic growth, and fiscal policy is traced over time. Third, the critical link between income distribution and growth is provided by the theory of public choice and in particular the median voter theorem. The impact of income distribution on growth is viewed as being mediated through a political process. Taking their market income as a starting point, voters assess their estimated benefits and losses from redistribution, and vote on redistribution policy. In this way redistribution can affect economic growth.[1]

Differences in public policies are one possible explanation for differences in countries' economic growth rates. It is reasonable to assume that if incentives to accumulate capital are low (e.g. under conditions of financial repression or excessive taxation), private ownership of capital is banned, or legal titles are unclear, people will not invest as much as they would otherwise. If growth is related to investment, growth will be slower. However, public policy itself is the outcome of interests and political strengths of different social groups and individuals. One key difference between people is their ownership of assets and amounts of income they receive. Income inequality thus enters in the determination of policy (principally, in decisions on taxation and public expenditures).

The aforementioned studies model the public sector as financing public investment in production services, public investment in education, or redistribution through proportional taxation. The models have the appealing feature of incorporating political processes and economic structures. Political processes capture the way that individual preferences over fiscal policy are translated into macroeconomic policy. The economic structure illuminates the link between fiscal policy and economic growth.

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[1]There is also a literature linking income distribution to economic growth through credit market imperfections. For a comprehensive survey of this literature see Perotti (1994). We do not consider this class of models in this study.

Consider the situation of an extremely skewed distribution of market income and where all adults of eligible age are allowed to vote (full franchise).[2] In such a system, the median voter is relatively poor (his income is not much higher than the income of individuals belonging to the lowest decile) and has an interest to vote for extensive redistribution. If this happens, returns on assets owned by the rich will be lowered and the incentives for their accumulation reduced. This, in turn, may have a negative impact on growth. If this relation is valid at all levels of income, as Persson and Tabellini (1994) assume, income inequality will have a negative impact on growth. In empirical terms, it would be unlikely to find the constellation of highly unequal income distribution, full democracy, and fast growth. This constellation is even more unlikely to occur at low levels of absolute income.

Alesina and Rodrik (1991) similarly hold that higher inequality, reflected in individuals' capital–labor ratios that are highly skewed to the right, will be bad for growth. If capital–labor ratios are highly skewed to the right (a proxy for high income inequality), the median voter will choose a tax on capital that is higher than the tax compatible with the highest growth rate, because the median voter's gain from a proportional tax on capital will be greater than the tax he must pay. In other words, the median voter will have sufficiently little capital that the tax he pays will be small compared to the gain that he receives through government transfers financed out of the capital tax.

However, if government transfers themselves are favorable for growth (e.g., higher education expenditures) the nature of the relationship changes somewhat. At the extreme, the positive impact of transfers on growth may more than offset the negative impact of taxes and the relationship between high inequality and high redistribution (on the one hand) and high growth (on the other) may turn out to be positive. This is the point made by Saint-Paul and Verdier (1991).

In the model proposed by Perotti (1993) the relationship between inequality and growth is not monotonic. His model also generates endogenously the well-known Kuznets relationship. The Kuznets inverted U curve states that income inequality increases at low levels of per capita income as both physical and human capital are scarce, unequally distributed, and command high returns. As human and physical capital accumulate, the rate of return on both declines and the pool of people who have such capital increases. Income distribution becomes more equal.

To sum up, there is a link between incentives to accumulate productive assets (including education) and growth. The long-term growth rate of an economy can be viewed as being determined by the incentives to accumulate human and physical capital, i.e., rates of return on each, the extent of redistribution (which drives the wedge between the market and actual return appropriated by the economic agents), and the use to which the government puts the resources it receives from taxes. The extent of redistribution, in turn, is determined by inequality of income distribution (positively), the type of political regime in place (democracy versus authoritarian in very broad terms), degree of political participation of the poor in the political process (positively), and the level of development.

Empirical studies by Alesina and Rodrik (1991), Alesina and Perotti (1993), and Persson and Tabellini (1994) link initial income distribution to economic growth through transfers or productive government spending. However, no attempt has been made to discern the connection of initial income distribution to the evolution of future income distribution

[2]Market income is income that is received before any taxation or government transfers.

through the fiscal channel. This is surprising since the theoretical models of Perroti (1993) and Saint-Paul and Verdier (1991) illuminate the evolution of income distribution and economic growth.

Most empirical studies to date have used the cross-country regression framework. Some of the theoretical propositions, however, are related to the time series evolution of economies. While the growth literature has mostly used the cross-country regression framework to make intertemporal inferences, very strict assumptions on model specification have to be made in order for this approach to be valid.[3]

This study seeks to address two issues. First, it links initial income distribution and political regimes to the evolution of economic growth and income distribution through fiscal policy. Second, it identifies what type of fiscal policy low-income economies should implement in order to achieve sustainable economic growth and move to high level of per capita income. Fiscal policy consists of transfer payments or an income tax. Fiscal policy is determined by the level of development, distribution of income, and degree of political franchise. Reduced form equations are obtained from the political equilibrium endogenous growth models addressing distributional issues. Empirical tests of these reduced form equations are carried out by using cross-country data, as well as time series data from India and Taipei,China. Time series regressions for India and Taipei,China are conducted to capture the intertemporal inferences made by the theoretical models. India and Taipei,China are chosen for the country studies because of the availability of income distribution data over a span of 30 years.

The cross-country evidence suggests that lagged income distribution is linked to future economic growth and income distribution through transfer payments. Time series evidence from Taipei,China suggests that low-income economies may have to implement low levels of direct taxes, which is accompanied by a worsening distribution of income, in order to promote economic growth

The second section presents the theoretical model underlying the regression. Empirical tests are presented in the third section, and the fourth section contains the conclusion.

II. The Model

The theoretical model underlying the regressions is presented. Perotti's (1993) model is used because of its thorough description of the interactions over time between redistributive fiscal policy, income distribution, and economic growth. His model also has the unique feature of generating the Kuznets curve, which plots the intertemporal variation in income distribution. This is very appealing from an empirical point of view, since studies by Campano and Salvatore (1988), Jha (1996), and Ram (1988), find evidence for the existence of the Kuznets curve based on cross-country data. Alesina and Rodrik (1991) and Persson and Tabellini (1994) give no insight on the evolution of income distribution. In their model income distribution remains fixed over time. Saint-Paul and Verdier's (1991) study has the result that the distribution of income converges to perfect equality in the steady state. Both

[3]The basic assumption underlying cross-country regressions is that the relationship to be estimated is time and space invariant. Technically the following equation has to hold $y_{it} = f(X_{it}) + \mu_{it}$. If the function $f(X_{it})$ is not independent of time and space, the cross country regression framework is inappropriate for making intertemporal inferences. See Heerink (1994) for a full discussion of this issue.

of these features do not match the existing cross-country or time series observations on income distribution.

In Perotti's two-period model, the economy consists of three groups of agents *i* belonging to income class *h, m,* or *l.* There is no capital market, uncertainty, and discounting. Preferences are represented by a linear utility function. In the first period, agents decide whether to invest in education or not, how much to consume, and the income tax rate. The cost of education is normalized to 1. Taxes, *T,* are proportional to pretax income. The revenue from taxation is redistributed as a per capita subsidy, which is constant across individuals. The government budget is always balanced. There are costs to collecting taxes. Suppose n_1 represents per capita income in period 1. Tn_1 is the amount of taxes collected, while individuals receive a subsidy net of collection costs an amount $n_1(T\text{-}T^2)$.

The model generates the following results.

At a very low level of per capita income, the median voter will not vote for a high level of redistribution since the resulting income distribution will not allow anybody to accumulate significant amounts of human capital. The economy will be stuck in a poverty trap. For growth to occur, the median voter will have to be relatively close to the high income groups in order to favor low levels of redistribution. Redistribution is thus less, the rich are able to accumulate capital, and the society's income grows. The distribution of income worsens. The two conditions that promote growth in a poor society are: the median voter must not be too poor to favor high redistribution, and the rich must be sufficiently rich to be able to accumulate capital.

In rich societies, the situation changes. The key requirement is larger redistribution. The growth rate will be higher the more widely spread is education. This requires that even the poor are able to invest in education, which, in turn, requires sizable redistribution. Sufficient redistribution will occur only if the median voter is now relatively close to the poor, and if the poor are not so destitute that no amount of redistribution will allow them to invest in education. At each level of income, the political process needs to deliver the right amount of redistribution to promote growth. At low levels of income, growth will proceed only if inequality is substantial. But at some sufficiently high income levels, the society will fail to grow unless investment in education pervades most or all income groups and income inequality declines.

In a cross section of countries we can make the following propositions, based on the model's results.

(1) Countries with low and intermediate levels of income will have low levels of redistribution. Countries whose incomes exceed the intermediate levels of income will have high levels of redistribution, of which the high-income economies will have the largest levels of redistribution. Hence in a cross section of countries we should observe a convex relationship between redistributive fiscal variables and level of per capita GDP. This U curve relationship traces the optimal fiscal policy at each level of per capita GDP necessary for ongoing growth. We therefore expect a positive sign on the coefficient for the fiscal variable in the growth regression if the U curve relationship exists.

(2) An increase in the share of the median income group (proxied by the sum of the third and fourth quintiles), for a given level of democracy, leads to a decrease in redistribution.

We expect the following empirical regularities based on time series observations from India and Taipei,China.

(3) Countries starting at a low level of income, which have continued to be plagued by low levels of income across time (India) have increasing levels of redistribution. The effect of an increase in redistribution in these countries is low economic growth accompanied by an improving income distribution.

(4) Countries that started at a low level of income, but have moved up to the intermediate level of income across time (Taipei,China) have decreasing levels of redistribution. As redistribution decreases in these countries, economic growth should increase, accompanied by a worsening distribution of income.

III. Empirical Tests

Fiscal policy is approximated either by the tax/GDP ratio or transfers/GDP ratio. Fiscal policy may be determined by the type of political regime in existence (democracy, left wing, or right-wing authoritarianism) and the level of income inequality. According to the model discussed in the previous section, the poor will vote for taxation and government spending because they expect to gain therefrom.[4] However, income inequality has to be "filtered" through the political regime in order to determine fiscal policy.

The evolution of the distribution of income is determined by the level of per capita income and fiscal policy. In low-income economies, an increase in redistribution may worsen the postfiscal distribution of income, while in intermediate and high-income economies, an increase in redistribution may improve the postfiscal distribution of income.

An explanation for changes in growth performance is posited by looking at growth rates over the sample period. The growth rate during this period is determined by fiscal policy, which is an endogenous variable in this case, and a set of control variables. The control variables include political stability, investment/GDP ratio, level of secondary education, bureaucratic efficiency, initial capital stock, and population growth.

A. Cross-country Regressions

The proxy for current income distribution is the Gini coefficient in the late 1980s to early 1990s ($Gini_{i,t}$).[5] The median voter's position within the income distribution is represented by the share of national income of the third and fourth quintiles of the population around 1960 *(Mid)*. For the developing countries, we use the data set compiled by Chen, Dutt, and Ravallion (1993). For the developed countries we make use of the data contained in the Luxembourg study and also reprinted in Bishop, Formby, and Smith (1991). Both of these data sets coverage is for the 1980s to 1990s. We make use of the Paukert (1973) data set for the initial Gini coefficient and share of national income of the median voter.

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[4]This was the consideration that prevented further extension of the franchise in Western Europe in the 19th century: the conflict between full democracy and preservation of private property.

[5]The Gini coefficient measures the size distribution of income. The Gini coefficient takes on values between 0 and 100 percent. A higher value indicates larger inequality.

The following reduced form equations represent propositions 1 and 2 (mentioned on page 4), where *Mid* is the pretax share of national income of the third and fourth quintile of the population in country *i* around the year 1965. $Trans_i$ is level of transfers in country *i* over the period 1970 to 1988.

$$Gini_i = a_0 + a_1 Trans_i + a_2 Trans_i * GDP_i + u_i \quad (1)$$

$$Trans_i = b_0 + b_1 GDP_{i,60} + b_2 GDP_{i,60}^2 + b_3 Mid + b_4 Mid * Dem + v_i \quad (2)$$

$$Growth_{i,7088} = c_0 + c_1 Trans_i + c_2 Trans_i * GDP_{i,60} + c_j X_j + w_i \quad (3)$$

Dem is a composite index of the degree of political participation, political freedom, and democracy in country *i* averaged over the years 1973 to 1988. $Gini_i$ is the posttax Gini coefficient for country *i* in the late 1980s to early 1990s. X is a set of control variables included in most cross-country regressions.[6] The control variables include sociopolitical instability index *(Spi)*, population growth rate *(Popgr)*, per capita GDP in 1960 (GDP_{60}), bureaucratic efficiency index *(Bi)*, investment to GDP ratio *(Inv)*, and secondary education attainment (Sec_{70}).[7]

The interaction term, *Trans*GDP*, is included in Equation (1) to test if the relationship between the ratio of transfers and Gini coefficient is sensitive to the level of per capita income. Hence apriori $(a_1 + a_2 * GDP_{60}) > 0$ for low-income economies and $(a_1 + a_2 * GDP_{60}) < 0$ for intermediate and high-income economies.

The relationship between per capita income and the level of transfers that generates ongoing growth is expected to be convex, hence $b_1<0$ and $b_2>0$. The effect of the share of the median income groups in national income, *Mid*, on transfers should be negative. However, strictly speaking, this is only true in democracies where the level of government transfers reflects the preference of voters. To capture the effect of these preferences on transfers, the interaction term *Mid*Dem* is included in Equation (2). Apriori, we expect $b_3<0$, and $b_3+b_4<0$.

The relationship between the transfers / GDP ratio and economic growth rate varies across levels of per capita income. An increase in the transfers / GDP ratio at a low level of income decreases growth. An increase in transfers / GDP ratio at an intermediate or high level of income increases the rate of economic growth. To capture these differential effects across levels of income, the interaction term *Trans*GDP* is included in Equation (3). To control for Wagner's law, GDP_{60} is included as a regressor in Equation (2).[8]

From column 1 in Table 1 we see that the coefficient on the level of transfers is negative and significant at the 5 percent level. This indicates that as the ratio of transfers increases, the distribution of income improves. Increasing transfer payments by one standard deviation (9.5 percent) improves the distribution of income by 0.001 percent, which

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[6]Levine and Renelt (1990) have shown that without these control variables, most growth regressions will suffer from omitted variables bias.

[7]See Appendix B for details on the transfers ratio, political instability index, and sociopolitical instability index. A higher value of the political rights index, *Dem*, represents a higher degree of political freedom. A higher value of *Spi* indicates more sociopolitical unrest.

[8]According to Wagners's law as the level of average income increases, government expenditures increase.

implies that redistribution is not very effective in generating income equality. The coefficient on the interaction term is insignificant at the 5 percent level, which implies that the level of development has no effect on the success of transfer policy.

Table 1: Cross-country Estimates

	$Gini_I$	$Trans_i$	$Growth_{7088}$
Constant	39.38 (9.1)	-12.46 (-1.13)	1.19 (0.25)
$Trans_i$	-0.0001 (-3.16)		-0.35 (-2.07)
$Trans_i*GDP_{60}$	1.044 (1.94)		3.86e-05 (1.93)
GDP_{60}		0.011 (4.69)	-0.001 (-2.54)
GDP_{60}^2		-6.08e-07 (-3.40)	
Mid		0.67 (1.76)	
Mid*Dem		-0.96 (-3.27)	
Bi			0.55 (0.69)
Popgr			-1.61 (-2.74)
Sec_{70}			0.047 (1.50)
Spi			0.13 (1.71)
Inv			0.21 (2.86)

Note: Procedure used is the weighted two stage least squares method. T-statistics in parenthesis.

From the transfers regression (column two), we see that when the share of the median voter variable interacts with the democracy variable, the coefficient is negative and significant. This implies that in democracies, if the median voter is close to the higher income group, transfers will decrease (as indicated by proposition 2, which was mentioned on page 4). The coefficient on the share of the median voter variable alone is insignificant, which indicates that the median voter or the type of political institution alone does not determine the level of transfers. It is the interaction of the median voter with the degree of political freedom that determines the level of transfers, and only then are voters' preferences truly represented by the political process.

Column two also indicates a weak inverted U relationship between transfers and per capita income, implying that the wrong level of redistribution is taking place at each level of per capita income. This result provides an explanation for the negative coefficient on *Trans* in the column three growth regression. If the wrong level of redistribution is implemented at each level of per capita income, redistribution should impede economic growth. The right

amount of redistribution in this context means that the tax rate used to finance the transfers is not so high that the incentives for investment are eroded, e.g., the optimal growth promoting level of redistribution is being set at each level of income. Other studies by Perotti (1994) and Devarajan, Vinaya, and Zhou (1992) find a positive relation between transfers and economic growth, however, they claim that this is inconsistent with the theory. The inconsistency arises only if the level of redistribution is not set at the optimal level thereby causing an increase in transfer payments to retard economic growth (in this case the level of redistribution would be concave in per capita income).

The coefficient on transfers in the growth regression has the right sign, given that the wrong level of redistribution has been implemented, and is significant. An increase in transfer payments by one standard deviation leads to a decrease in economic growth by 3.33 percent. This result suggests that the empirical evidence is strong in substantiating the theoretical proposition that income distribution and the degree of franchise influence the economic growth rate through the fiscal channel in a cross section of countries.

The coefficients on population growth and investment ratio are significant at the 5 percent level and have the right sign. Increases in population growth lead to poor growth performance. Increasing the investment ratio stimulates economic growth. The convergence hypothesis put forth by Barro (1991) is also evident according to the negative sign on GDP_{60}. However, this is a side result of the tests since the theory does not make any predictions about convergence.

For a given degree of franchise, an egalitarian income distribution today causes an increase in transfer payments. This increase in transfers leads to an improvement of the future income distribution and worsening of the economic growth rate, on average across countries.

Other cross-country studies by Alesina and Perotti (1993) and Perotti (1994) find very weak evidence of the linkage of lagged income distribution to future economic growth through the fiscal channel. Their results may be partly driven by the type of instruments used for the two stage least squares estimation. If the instruments used for the first stage regression are weak or they are correlated with the error term, the two stage least squares method will yield biased estimates.

B. Time Series Regressions

In this section time series data from India and Taipei,China is used to test propositions 3 and 4.[9] Unfortunately, time series data on pretax distribution of income is not available for either of these countries. Hence we are not able to estimate the fiscal variable equation. Estimation of the fiscal variable equation without including a proxy for the pretax distribution of income would lead to omitted variable bias. Hence we only estimate the equations for annual average rate of economic growth and annual posttax distribution of income, which is proxied by the Gini coefficient. We give a qualitative assessment of the evolution of the tax/GDP ratio for the sample period. Transfers as a percentage of GDP in both countries is very small and showed little variation, hence the ratio of direct federal government taxes to GDP is used as the proxy for the redistribution fiscal variable.

Comparing India and Taipei,China is an interesting exercise. The two countries have had very different political regimes after World War II. India has been characterized by a democratic form of government, while Taipei,China started out with a right-wing

[9]See Appendix B for details of the data and sample period.

authoritarian regime in the 1960s and has implemented democratic reforms since the early 1990s, which corresponds to the time period for which the data is available. Both countries in the 1960s were classified as low-income economies, hence the initial level of development was similar. However, in terms of growth performance and income distribution over time, there are stark differences. During the sample period, approximately 30 years, India's average annual economic growth rate was 1.89 percent and average posttax Gini coefficient was 32.98 percent. Taipei,China's average growth rate and posttax Gini coefficient was 6.12 and 29.63 percent, respectively.

The objective in this section is to determine why there are such stark differences in the evolution of economic growth and posttax distribution of income and whether these differences can partly be explained by the type of fiscal policy implemented in the two countries.

The econometric model specification for the two countries is given by the following equations.

$$Gini_t = \beta_0 + \beta_1 Tax\,ratio_t + \beta_2 GDP_{t-2} + \psi_t \quad (4)$$

$$Growth\,rate_t = \alpha_o + \alpha_1 GDP_t + \alpha_2 Tax\ ratio_t + a_j X_j + \xi_t \quad (5)$$

where X_j is a set of control variables, consisting of population growth rate and investment to GDP ratio. Tax ratio is the ratio of direct taxes collected by the federal government to real GDP.

The instrument selection procedure and test for regressor endogeneity is implemented for both Indian and Taipei,China data.

(1) *Time Series Regressions for India*

In Equation (4) we expect $\beta_1<0$, $\beta_2=0$, and $\alpha_2<0$. β_2 is expected to be zero for India since the economy has not really taken off in terms of sustained growth and has been accompanied by high redistribution.

Table 2 confirms our ex ante hypothesis and is consistent with proposition 4. Even though the posttax distribution improves as a result of an increase in the tax ratio, economic growth is adversely affected.

(2) *Time Series Regressions for Taipei,China*

In Equation (4) we expect $\beta_1<0$, $\beta_2>0$, and $\alpha_2<0$. From Table 2 we see that an increase in the tax ratio has no effect on the posttax distribution of income since the coefficient is insignificant, even though it has the right sign. As the level of per capita income has increased, the distribution of income has worsened, which is what we would expect for an economy like Taipei,China.

The coefficient on the tax ratio variable is negative and significant at the 10 percent level in the growth regression, which indicates that an increase in the ratio of taxes worsens the rate of economic growth in economies that start out at a low level of income. These results are weakly consistent with proposition 4. The data for the tax ratio has an upward trend for the period 1953-1992.

Table 2: Time Series Estimates

	$Gini_t$ (India)	$Growth\ rate_t$ (India)	$Gini_t$ (Taipei,China)	$Growth\ rate_t$ (Taipei,China)
Constant	34.88 (4.66)	-47.90 (-1.47)	24.85 (35.53)	-9.50 (0.33)
$Tax\ ratio_t$	-2.08 (-3.13)	-5.85 (-2.15)	-0.11 (-0.86)	-1.59 (-1.83)
GDP_{t-2}	0.01 (1.19)		4.04e-05 (3.89)	
GDP_t		0.04 (3.58)		0.0002 (1.21)
$Popgr_t$		14.0 (0.97)		11.75 (0.75)
Inv_t		2.21 (1.55)		-0.86 (-1.31)

Note: Procedure used is the weighted two stage least squares method. T-statistics in parenthesis.

This is inconsistent with what we would expect for an economy that has progressed from a low level of income to an intermediate level of income according to Perotti's model.

IV. Conclusion

The evidence from a cross section of countries suggests that the fiscal channel is operative in linking initial income distribution to future economic growth and distribution of income. An increase in the median voter's share of national income for a given level of democracy decreases transfer payments. A decrease in transfer payments on average across countries improves the rate of economic growth. However, a decrease in transfer payments worsens the future posttransfer distribution of income.

In contrast to other studies, our cross-country results indicate that an inegalitarian initial income distribution promotes future economic growth. This result is consistent with our other finding that on average across countries, the suboptimal level of redistribution (in terms of promoting economic growth) has been implemented at each level of per capita income.

Time series evidence from India and Taipei,China from 1953 to 1992 indicates that increasing the tax ratio hinders economic growth and improves the distribution of income.

The distribution of income improved during the 1954-1963 period and shows some volatility during the 1964-1992 period, as per capita income increased in India. In Taipei,China per capita income has increased to the intermediate stage, and has been accompanied by high growth and improvements in income distribution during the 1964-1969 period. However the distribution of income worsened during the 1970-1992 period.

The policy implications for low-income economies are that redistribution should be set appropriately such that the upper income groups are not discouraged to invest in order to promote high rates of economic growth. However, during this stage of development, a worsening distribution of income must be incurred.

Appendix A
Econometric Model

Suppose the reduced form of the model we are interested in estimating is given by:

$$y = \beta \quad X + u \tag{A1}$$

First, a set of instruments is chosen. Then Godfrey's test for instrument validity is applied. The test consists of estimating equation five by the instrumental variables (IV) procedure. Then the residuals obtained from the IV estimation are regressed on the full set of instrumental variables, *Z*. The number of observations multiplied by the R^2 from regression five is distributed chi square with m-k degrees of freedom (m and n represent the number of instruments and explanatory variables respectively) and is used to test the null hypothesis that *Z* contains a valid set of instruments.

$$\hat{u}_{\mathrm{IV}} = \gamma Z + \varepsilon \tag{A2}$$

Davidson and MacKinnon (1993) have stressed that in finite samples, which we have, the number of instruments should be small relative to the sample size. Otherwise the small sample bias of an IV estimator will be large, even though asymptotic efficiency will increase. In our study the number of observations is large compared to the number of instruments, hence small sample bias is not of serious concern.

Once a set of valid instruments has been chosen in terms of conforming to the overidentifying restrictions, we can test whether these instruments are correlated with the suspect endogenous regressors. An F test, consisting of estimating equations seven and eight, tests the null hypothesis that the coefficients on *Z* are jointly equal to 0. This is essentially a goodness of fit test. If the null hypothesis is violated, then *Z* contains the relevant set of regressors.

$$y_{un} = \omega X + \theta Z + \upsilon \tag{A3}$$

$$y_c = \phi \quad X + \mu \tag{A4}$$

Once a set of variables is determined as being the acceptable instruments, a test to determine endogeneity of the suspect regressor has to be conducted. Hausman's (1978) specification test for endogeneity consists of using the residuals obtained from estimating the first stage equation for the suspect endogenous variable, X_i, as a regressor in Equation 9. Construction of an F-test enables us to test the null hypothesis that *X* is an exogenous variable.

$$y = \ell X + \kappa \quad \hat{u} + \rho \tag{A5}$$

We use two types of estimation for the econometric models. Ordinary least squares (OLS) is used as the benchmark procedure. To check for the presence of heteroscedasticity we utilize White's (1984) test. High order serial correlation is detected by using a Lagrange multiplier test. Measurement error in the explanatory variables is detected by implementing Klepper-Leamer's (1984) test.

From the theoretical model we know a priori that the fiscal variable determines the future evolution of posttax income distribution and economic growth. However, fiscal policy is itself determined by lagged pretax income distribution, level of democracy, and level of development. Hence the econometric model will consist of a system of simultaneous equations. The standard procedure for estimation in a simultaneous equations framework is the IV procedure.

However, the choice of instruments when estimating within a simultaneous equations framework is crucial. Recent studies by Bound, Jaeger, and Baker (1993); Card and Vella (1995); and Nelson and Startz (1990) have indicated that if the instruments are correlated with the error term or weakly correlated with the endogenous regressor, the instrumental variable estimators will be severely biased.

The recent empirical work in the endogenous growth and income distribution literature do not mention the process by which instruments are selected. Usually the ad hoc procedure of using all the predetermined and exogenous variables as the instruments is utilized. At most, the choice of instruments is based on economic theory. Diagnostic tests are never presented to justify the use of the chosen instruments. Obtaining insignificant coefficients on fiscal variables in growth regressions in these studies maybe partly due to the use of inappropriate instruments.

In this study we follow Klepinger, Lundberg, and Plotnik's (1995) selection criteria for instrumental variables. Instruments are chosen based on two criteria. They must be valid according to a test of overidentifying restrictions and relevant in explaining the endogenous regressor.

Since the reduced form equations are within the simultaneous equations framework, *Trans* maybe an endogenous regressor. First we select a set of instruments, which includes *Inv, Popgr, Spi Bi*, Sec_{70}, GDP_{60}, and the ratio of marginal income taxes to *GDP* (*Mit*). Then we conduct the overidentifying restrictions test and goodness

of fit test to determine whether these instruments are valid and relevant. After the instruments have met the selection criteria, Hausman's test for endogeneity is performed. The aforementioned instruments meet the selection criteria. *Trans* is determined to be an endogenous variable. Therefore, the next set of regressions utilizes a weighted two stage least squares (W2SLS) procedure to correct for heteroskedasticity and simultaneity bias.[1]

All of the econometric models used for the cross-country and country analysis are overidentified (there are more instruments than regressors) according to the order condition. To test the validity of a set of instruments in an overidentified model (overidentifying restrictions), Godfrey's (1988) test is utilized.

[1]Results of the instrument selection process are available from the author. Using only the exogenous variables, as most studies do, gave very poor results in terms of statistical significance of the coefficients. This set of instruments did not pass the goodness of fit test.

Appendix B
Details of Data

Cross-country Regressions

We use as our source for the pretax income distribution data and initial distribution of wealth Paukert (1973). For the posttax income distribution data Chen, Dutt, and Ravallion (1993) and Bishop, Formby, and Smith (1991).

We use the Barro-Lee (1993) primary and secondary school attainment proxy for the human capital stock. The Barro-Lee proxy for human capital considers the years of completed schooling for persons aged 25 and over, rather than considering only persons participating in the labor force. The primary schooling attainment variable represents the percentage of primary schooling attained in the total population, while secondary schooling attained represents the percentage of secondary schooling attained in the total population. For initial levels of human capital stock (Sec_{70}) we use the 1970 data for secondary education attainment.

The initial level of development is captured by real per capita GDP in 1960 (GDP_{60}). Real per capita GDP is measured at international prices of 1985 using the Summers and Heston (1995) data set.

The redistribution variable, *Trans*, represents expenditure on social security and welfare. *Trans* is an average over the years 1970 to 1988 and is obtained from the IMF Government Finance Statistics (GFS).

The political freedom index (*Dem*) is constructed using averages over 1973-1988. Its value lies in the interval 0 to 1. A high value of *Dem* reflects a higher degree of political freedom. This index is obtained from Gastil (1982).

Spi is the sociopolitical instability index constructed from data averaged over 1960-1985. This data was obtained from Alesina and Perotti (1993).

Bi is the bureaucratic efficiency index constructed as an average 1980-1983. A high value of *Bi* means that the country's institutions are well-functioning. This data is obtained from Mauro (1995).

Time Series Regressions

For India, data for real per capita GDP, average annual economic growth, and the control variables are from Summers and Heston (1995) and are for the period 1953-1992. India does not have direct estimates of income distribution on a time series basis. Due to the absence of time series data, most studies have utilized the National Sample Survey data on distribution of consumption. Chen, Dutt, and Ravallion (1993) and Jain (1975) report national Gini coefficients representing the posttax distribution of consumption expenditure. There are 14 points from compiled from these two sources covering the period 1958 to 1991.

White's test for heteroscedasticity confirms that the error term is not iid. The Lagrange multiplier does not indicate the presence of serial correlation.

Hausman's specification test reveals that the tax ratio is an endogenous variable. To correct for heteroskedasticity and endogeneity, a weighted two stage least squares procedure is used.[2]

For Taipei,China, data for real per capita GDP, average annual economic growth, and the control variables are from National Accounts for 1951-1992 (1993) compiled by the Directorate General of Budget, Accounting, and Statistics, Taipei,China. The data is for the period 1953-1992. Posttax Gini coefficients are obtained from Report on the Survey of Personal Income Distribution in Taipei (Republic of China 1992), compiled by the Directorate General of Budget, Accounting, and Statistics. The data is for the period 1964-1992, and consists of 23 observations.

White's test for heteroskedasticity confirms that the error term is not iid. The Lagrange multiplier test indicates the presence of serial correlation. A quasi-difference method is used to correct for serial correlation.

Hausman's specification test reveals that the tax ratio is an endogenous variable. To correct for heteroskedasticity and endogeneity we use a W2SLS procedure.

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[2]For the growth rate regression, the instruments are $Popgrowth_{t-1}$, Inv_{t-1}, GDP_{t-1}, and $Gini_{t-1}$. In the Gini regression the instruments are $Popgrowth_{t-1}$, Inv_{t-1}, GDP_{t}, and $Gini_{t-1}$.

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